

Fat Quality Assessments of Feed-Grade and Pet Food-Grade Poultry By-Product Meals¹

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Primary Audience: Feed Mill Managers, Live Production Personnel, Nutritionists, Quality Control Personnel

SUMMARY

Ether extract composition of poultry by-product meal (PBM) varies among feed-grade and pet food-grade sources. Because feed-grade PBM contains a wider variety of processing residues than pet food-grade PBM, it is presumed to be of lower fat quality (i.e., stability). This potential difference in fat quality, or stability, between PBM sources can be accentuated by high environmental temperatures. A total of 46 PBM samples (25 feed-grade and 21 pet food-grade) were collected from commercial feed mills located in the southeastern US within 60-d intervals during the winter and summer months.

For samples from winter collection, feed-grade PBM had lower fat stability than pet food-grade PBM. Conversely, pet food-grade PBM samples received in the summer were characterized as having poor stability, and the amount of analyzed residual antioxidant concentration in pet food-grade PBM was half that found in the feed-grade PBM samples. Seasonal effects appeared to be related to the extent of fat oxidation. In general, samples obtained in the summer had poor stability when compared with those collected during the winter, regardless of source. These results confirmed that fat in PBM requires an adequate amount of antioxidant protection, even when meals are derived from prime offal components.

Key words: by-product meal, fat quality, feedstuff, ingredient, poultry by-product meal, rendered protein

2004 J. Appl. Poult. Res. 13:680–683

DESCRIPTION OF PROBLEM

Poultry by-product meal (PBM) is a valuable protein source for poultry. In recent years, pet food companies have mandated to renderers that PBM be manufactured without “low quality” by-

product fractions such as feathers, heads, feet, and on-farm mortality. High quality pet food-grade rendered product would thus be composed of soft offal, trim, and fresh product from deboning operations. This has resulted in the current feed-grade PBM being of lower protein content and amino

¹Mention of trade names or commercial products in this publication is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the US Department of Agriculture.

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TABLE 1. Fat stability indicators of pet food-grade and feed-grade poultry by-product meals collected during the winter

Item	Pet food grade ^A				Feed grade ^B			
	Max ^C	Avg ^D	Min ^E	SD	Max ^C	Avg ^D	Min ^E	SD
IPV ^F (mEq/kg)	26.2	3.3	0.2	8.1	294.6	72.8	0.6	118.8
4-h AOM ^G (mEq/kg)	12.0	2.1	0.2	3.7	7.0	3.0	0.6	2.3
20-h AOM ^H (mEq/kg)	3.1	1.2	0.2	1.1	5.9	3.2	0.6	1.9
Ethoxyquin (ppm)	391	139	20	142	366	116	0.2	107

^AValues are from 10 samples collected from feed mills in southeastern US.

^BValues are from 15 samples collected from feed mills in southeastern US.

^CDenotes the maximum value.

^DDenotes the average value.

^EDenotes the minimum value.

^FInitial peroxide value.

^GFour-hour active oxygen method peroxides.

^HTwenty-hour active oxygen method peroxides.

TABLE 2. Fat stability indicators of pet food-grade and feed-grade poultry by-product meals collected during the summer

Item	Pet food grade ^A				Feed grade ^B			
	Max ^C	Avg ^D	Min ^E	SD	Max ^C	Avg ^D	Min ^E	SD
IPV ^F (mEq/kg)	326.0	123.9	1.0	118.1	116.2	42.6	0.2	20.4
4-h AOM ^G (mEq/kg)	152.6	68.4	1.1	62.6	17.0	5.1	0.2	2.6
20-h AOM ^H (mEq/kg)	127.4	59.5	1.0	55.9	29.1	9.1	0.2	7.4
Ethoxyquin (ppm)	156	62	20	64	440	135	20	164

^AValues are from 11 samples collected from feed mills in southeastern US.

^BValues are from 10 samples collected from feed mills in southeastern US.

^CDenotes the maximum value.

^DDenotes the average value.

^EDenotes the minimum value.

^FInitial peroxide value.

^GFour-hour active oxygen method peroxides.

^HTwenty-hour active oxygen method peroxides.

TABLE 3. Fat stability indicators of pooled samples of pet food-grade and feed-grade poultry by-product meals as affected by season

Item	Summer ^A				Winter ^B			
	Max ^C	Avg ^D	Min ^E	SD	Max ^C	Avg ^D	Min ^E	SD
IPV ^F (mEq/kg)	326.0	74.6	0.2	100.7	294.6	43.8	0.2	96.1
4-h AOM ^G (mEq/kg)	152.6	35.7	0.2	54.6	12.0	3.0	0.2	2.6
20-h AOM ^H (mEq/kg)	127.4	33.8	0.2	47.0	5.9	1.8	0.2	2.3
Ethoxyquin (ppm)	440	122	20	111	391	120	20	125

^AValues are from 21 samples collected from feed mills in southeastern US.

^BValues are from 25 samples collected from feed mills in southeastern US.

^CDenotes the maximum value.

^DDenotes the average value.

^EDenotes the minimum value.

^FInitial peroxide value.

^GFour-hour active oxygen method peroxides.

^HFour-hour active oxygen method peroxides.

acid digestibility and varying in nutrient composition [1], because the high quality offal components have been diverted to pet food meals.

Dozier et al. [1] evaluated the proximate composition of feed-grade and pet food-grade PBM. It was determined that the ether extract content of feed-grade PBM ranged from 10 to 24%, whereas the pet food-grade PBM was less variable (e.g., 11 to 15% ether extract). The average content for feed-grade and pet food-grade PBM was 14.4 and 12.6%, respectively, which is in close agreement with the NRC [2] that cites ether extract content for feed-grade PBM as 13%. Information is limited on the differences in fat stability between pet food-grade and feed-grade PBM. This study examined fat stability and its variability in currently available feed-grade and pet food-grade sources of PBM.

MATERIALS AND METHODS

Forty-six PBM samples (25 feed-grade and 21 pet food-grade) were collected from commercial feed mills located in Delaware, Georgia, North Carolina, South Carolina, and Virginia during the winter and summer months of 2003. Initial peroxide, 4-h active oxygen method peroxides (AOM), and 20-h AOM of the samples were determined in duplicate according to AOCS methods [3, 4]. Ethoxyquin content was determined via methodology of the AOAC [5]. Maximum, minimum, and average values and their respective SD were calculated for each source of PBM.

RESULTS AND DISCUSSION

Fat stabilities of feed-grade and pet food-grade PBM collected during the winter months are presented in Table 1. The initial peroxide value of feed-grade PBM was higher and more variable

than that of pet food-grade PBM. In addition, pet food-grade PBM had lower average values for 4-h and 20-h AOM and higher concentrations of ethoxyquin than feed-grade PBM. In contrast, pet food-grade PBM obtained during the summer exhibited higher average values and more variability for each of the fat stability indicators than feed-grade PBM (Table 2).

This difference in fat stability between the PBM sources, as affected by season, may be attributable to residual antioxidant concentration. In the samples received in the summer, when high temperatures would be expected to negatively influence fat stability, the residual antioxidant present in the pet food-grade PBM was less than half of that found in the feed-grade samples. The lower antioxidant content of the pet food-grade PBM may be partially related to a perceived decreased demand for fat stability in pet food as these products are packaged in air-tight bags that are confined to indoor markets. The addition of a synthetic antioxidant to poultry fat has been shown to increase the time before a fat deteriorates. Romoser [6] found that adding 250 and 500 ppm of ethoxyquin to poultry fat resulted in 78 and 142 h, respectively, to reach a peroxide value of 20 mEq/kg. However, when no antioxidant was included in poultry fat, only 20 min were required to achieve 20 mEq/kg.

The adverse effect of high summer temperatures was evident for all indicators of fat stability (Table 3). Average values for initial peroxide, 4- and 20-h AOM were higher in the summer. Moreover, variation was more apparent in the summer than in the winter. This provides support for the addition of adequate concentrations of antioxidant to PBM during summer production, regardless of PBM source.

CONCLUSIONS AND APPLICATIONS

1. The perceived higher quality of pet food-grade PBM is not justified when considering fat stability.
 2. Pet food-grade PBM collected in the winter had lower average values of initial peroxide, 4-h and 20-h AOM than feed-grade PBM, but the opposite occurred with samples obtained during the summer.
 3. The residual antioxidant content of the pet food-grade PBM was 61% less than feed-grade source in samples acquired in the summer months.
 4. Renderers should add sufficient antioxidant to both feed-grade and pet food-grade PBM to avoid problems of rancidity, especially during summer production.
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REFERENCES AND NOTES

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